

CLAIMS

I claim:

- 1 1. An instrument for displaying temperature as color, the instrument comprising:
  - 2 a plurality of color sources, each color source being capable of engendering color of a
  - 3 different wavelength and variable apparent intensity, said each color source comprising
  - 4 an input capable of receiving a signal controlling color intensity of said each color
  - 5 source;
  - 6 an electronic device comprising:
    - 7 an input that receives temperature readings indicative of the temperature to be
    - 8 displayed,
    - 9 circuitry that determines a plurality of color intensity values for each temperature
    - 10 reading, one color intensity value per said each color source, and generates a plurality
    - 11 of color intensity signals to control intensities of the plurality of color sources, one
    - 12 color intensity signal per said each color source, the color intensity signal of said each
    - 13 color source being controlled by the color intensity value of said each color source,
    - 14 and
    - 15 a plurality of outputs coupling the color intensity signals to the inputs of the color
    - 16 sources, the color intensity signal of said each color source being coupled to the input of
    - 17 said each color source; and
    - 18 a combiner of the colors engendered by the plurality of color sources.
- 1 2. The instrument according to claim 1, wherein:
  - 2 said plurality of color sources comprises a plurality of light emitters capable of
  - 3 emitting light of variable intensity, one light emitter per color source, the color
  - 4 engendered by said each color source comprising the light emitted by the light emitter of
  - 5 said each color source, the color intensity signal of said each color source controlling
  - 6 intensity of the light emitted by the light emitter of said color source; and
  - 7 said combiner comprises a lens assembly positioned to receive and converge the light
  - 8 emitted by the light emitters.

1 3. The instrument according to claim 1, wherein the circuitry of the electronic device  
2 comprises a memory and a digital processor executing program code stored in the  
3 memory.

1 4. The instrument according to claim 3, wherein the temperature readings comprise  
2 digitized indications of temperature, the instrument further comprising an analog-to-  
3 digital converter that receives analog indications of temperature, and digitizes the analog  
4 indications of temperature to convert the analog indications of temperature into the  
5 digitized indications of temperature.

1 5. The instrument according to claim 4, further comprising a temperature sensor causing  
2 the analog indications of temperature to vary with temperature of the temperature sensor.

1 6. The instrument according to claim 5, wherein the circuitry of the electronic device  
2 causes the color intensity signal of said each color source to be a pulse-width modulated  
3 signal with duty cycle dependent on the color intensity value of said each color source.

1 7. The instrument according to claim 6, wherein the temperature sensor comprises a  
2 temperature-dependent current source.

1 8. The instrument according to claim 7, wherein the temperature-dependent current  
2 source provides current substantially proportional to temperature of the current source.

1 9. The instrument according to claim 6, wherein the temperature sensor comprises a  
2 thermistor.

1 10. The instrument according to claim 6, wherein the temperature sensor comprises a  
2 resistance temperature device.

1 11. The instrument according to claim 6, wherein the temperature sensor comprises a  
2 thermocouple.

1 12. The instrument according to claim 6, wherein the temperature sensor comprises a  
2 diode.

1 13. The instrument according to claim 6, wherein frequency of the pulse-width modulated  
2 signal is between about 25 Hz and 50 KHz.

1 14. The instrument according to claim 6, wherein the plurality of color sources comprises  
2 a plurality of substantially monochromatic color sources.

1 15. The instrument according to claim 14, wherein the plurality of color sources  
2 comprises a red color source, a green color source, and a blue color source.

1 16. The instrument according to claim 5, wherein the temperature sensor is remote from  
2 the plurality of the color sources.

1 17. The instrument according to claim 5, wherein the circuitry of the electronic device  
2 causes amplitude of the color intensity signal of said each color source to depend on the  
3 color intensity value of said each color source.

1 18. The instrument of claim 4, further comprising a serial connection between the analog-  
2 to-digital converter and the input of the electronic device for transmitting the digitized  
3 indications of temperature from the analog-to-digital converter to the input of the  
4 electronic device.

1 19. The instrument of claim 4, further comprising a parallel bus connection between the  
2 analog-to-digital converter and the input of the electronic device for transmitting the  
3 digitized indications of temperature from the analog-to-digital converter to the input of  
4 the electronic device.

1 20. The instrument of claim 4, further comprising a wireless connection between the  
2 analog-to-digital converter and the input of the electronic device for transmitting the

3 digitized indications of temperature from the analog-to-digital converter to the input of  
4 the electronic device.

1 21. The instrument according to claim 1, further comprising a plurality of buffer circuits  
2 coupling the outputs of the electronic device to the inputs of the color sources, a buffer  
3 circuit per said each color source, the buffer circuit of said each color source being  
4 interposed between the input of said each color source and the output of the electronic  
5 device corresponding to said each color source.

1 22. The instrument according to claim 21, further comprising an analog-to-digital  
2 converter that receives analog indications of temperature, and digitizes the analog  
3 indications of temperature to convert the analog indications of temperature into the  
4 temperature readings.

1 23. The instrument according to claim 22, wherein the electronic device further  
2 comprises a memory and a digital processor executing program code stored in the  
3 memory.

1 24. The instrument according to claim 21, further comprising a temperature sensor  
2 causing the temperature readings to vary with temperature.

1 25. The instrument according to claim 24, wherein the temperature sensor comprises a  
2 current source with linear current-temperature dependence.

1 26. The instrument according to claim 21, wherein the circuitry of the electronic device  
2 causes the color intensity signal of said each color source to be a pulse-width modulated  
3 signal with duty cycle dependent on the color intensity value of said each color source.

1 27. The instrument according to claim 26, wherein frequency of the pulse-width  
2 modulated signal is between about 25 Hz and about 50 KHz.

1 28. The instrument according to claim 21, wherein the circuitry of the electronic device  
2 causes amplitude of the color intensity signal of said each color source to depend on the  
3 color intensity value of said each color source.

1 29. The instrument according to claim 21, wherein:

2 said plurality of color sources comprises a plurality of substantially monochromatic  
3 light emitters capable of emitting light of variable intensity, one light emitter per color  
4 source, the color engendered by said each color source comprising the light emitted by  
5 the light emitter of said each color source, the color intensity signal of said each color  
6 source controlling intensity of the light emitted by the light emitter of said color source;  
7 and

8 said combiner comprises a lens assembly positioned to receive and converge the light  
9 of the light emitters.

1 30. The instrument according to claim 29, wherein the plurality of substantially  
2 monochromatic light emitters comprises a red LED, a green LED, and a blue LED.

1 31. The instrument according to claim 24, wherein the temperature sensor is remote from  
2 the plurality of the color sources.

1 32. An instrument for displaying temperature as emitted light, the instrument comprising:  
2 a multicolor LED device comprising:

3 a plurality of substantially monochromatic LEDs, each substantially  
4 monochromatic LED being capable of emitting light of a different wavelength, said  
5 each substantially monochromatic LED comprising an input for receiving a signal  
6 controlling the light emitted by said each substantially monochromatic LED, and

7 a lens assembly positioned to receive and converge the light emitted by the  
8 plurality of substantially monochromatic LEDs; and

9 an electronic device comprising:

10 an input that receives temperature readings indicative of the temperature to be  
11 displayed,

12       circuitry that determines a plurality of color intensity values for each temperature  
13       reading, one color intensity value per said each substantially monochromatic LED,  
14       and generates a plurality of color intensity signals to control intensities of the  
15       plurality of substantially monochromatic LEDs, one color intensity signal per said  
16       each substantially monochromatic LED, the color intensity signal of said each  
17       substantially monochromatic LED being controlled by the color intensity value of  
18       said each substantially monochromatic LED, and

19       a plurality of outputs coupling the color intensity signals to the inputs of the  
20       substantially monochromatic LEDs, the color intensity signal of said each substantially  
21       monochromatic LED being coupled to the input of said each substantially  
22       monochromatic LED.

1       33. The instrument according to claim 32, wherein the circuitry of the electronic device  
2       comprises a memory and a digital processor executing program code stored in the  
3       memory.

1       34. The instrument according to claim 33, wherein the temperature readings comprise  
2       digitized indications of temperature, the instrument further comprising an analog-to-  
3       digital converter that receives analog indications of temperature, and digitizes the analog  
4       indications of temperature to convert the analog indications of temperature into the  
5       digitized indications of temperature.

1       35. The instrument according to claim 34, further comprising a temperature sensor  
2       causing the analog indications of temperature to vary with temperature of the temperature  
3       sensor.

1       36. The instrument according to claim 35, wherein the circuitry of the electronic device  
2       causes the color intensity signal of said each substantially monochromatic LED to be a  
3       pulse-width modulated signal with duty cycle dependent on the color intensity value of  
4       said each substantially monochromatic LED.

1 37. The instrument according to claim 36, wherein frequency of the pulse-width  
2 modulated signal is between about 25 Hz and 50 KHz.

1 38. The instrument according to claim 35, wherein the temperature sensor is remote from  
2 the plurality of the substantially monochromatic LEDs.

1 39. The instrument according to claim 38, further comprising a plurality of buffer circuits  
2 coupling the outputs of the electronic device to the inputs of the substantially  
3 monochromatic LEDs, a buffer circuit per said each substantially monochromatic LED,  
4 the buffer circuit of said each substantially monochromatic LED being interposed  
5 between the input of said each substantially monochromatic LED and the output of the  
6 electronic device corresponding to said each substantially monochromatic LED.

1 40. The instrument of claim 34, further comprising a serial connection between the  
2 analog-to-digital converter and the input of the electronic device for transmitting the  
3 digitized indications of temperature from the analog-to-digital converter to the input of  
4 the electronic device.

1 41. The instrument of claim 34, further comprising a parallel bus connection between the  
2 analog-to-digital converter and the input of the electronic device for transmitting the  
3 digitized indications of temperature from the analog-to-digital converter to the input of  
4 the electronic device.

1 42. The instrument of claim 34, further comprising a wireless connection between the  
2 analog-to-digital converter and the input of the electronic device for transmitting the  
3 digitized indications of temperature from the analog-to-digital converter to the input of  
4 the electronic device.

1 43. A system for monitoring temperature, the system comprising:

2 a color display capable of displaying a temperature object as a combination of a  
3 plurality of basic constituent colors of variable intensities so that the temperature object  
4 appears as an object of one color;

5 an electronic device comprising:

6 an input that receives temperature readings indicative of the temperature, and

7 a processor that determines a plurality of color intensity values for each  
8 temperature reading, one color intensity value per basic constituent color; and

9 a video card coupled to the color display and to the processor to receive the plurality  
10 of color intensity values from the processor and cause the color display to output the  
11 temperature object as a combination of the plurality of basic constituent colors with each  
12 basic constituent color having intensity determined by the color intensity value of said  
13 each basic constituent color.

1 44. The system for monitoring temperature of clam 43, further comprising an analog-to-  
2 digital converter that receives analog indications of temperature, and digitizes the analog  
3 indications of temperature to convert the analog indications of temperature into the  
4 temperature readings.

1 45. The instrument according to claim 44, further comprising a temperature sensor  
2 causing the analog indications of temperature to vary with temperature of the temperature  
3 sensor.

1 46. The instrument according to claim 45, wherein the temperature sensor comprises a  
2 current source with substantially linear current-temperature dependence.

1 47. The instrument according to claim 45, wherein the temperature sensor comprises a  
2 thermistor.

1 48. The instrument according to claim 45, wherein the temperature sensor comprises a  
2 thermocouple.

1 49. The instrument according to claim 45, wherein the temperature sensor comprises a  
2 diode.

1 50. The instrument according to claim 45, wherein the temperature sensor comprises a  
2 resistance temperature device.

1 51. The instrument according to claim 45, wherein the plurality of basic constituent  
2 colors comprises red, green, and blue colors.

1 52. The instrument according to claim 44, wherein the processor runs under Windows  
2 operating system.

1 53. The instrument according to claim 45, wherein the temperature sensor is remote from  
2 the color display.

1 54. An instrument for displaying temperature as color, the instrument comprising:  
2 means for engendering colors of different wavelengths and intensities controlled by a  
3 plurality of color intensity signals, one color intensity signal per engendered color;  
4 means for receiving temperature readings indicative of the temperature to be  
5 displayed and determining a plurality of color intensity values for each temperature  
6 reading, one color intensity value per said each engendered color;  
7 means for generating the plurality of color intensity signals controlled by the plurality  
8 of color intensity values; and  
9 means for converging the engendered colors.

1 55. The instrument of claim 54, further comprising means for receiving analog  
2 temperature indications and digitizing the analog temperature indications to obtain  
3 digitized temperature indications, wherein the temperature readings comprise the  
4 digitized temperature indications.

1 56. The instrument of claim 55, further comprising temperature sensing means for  
2 sensing temperature and generating the analog temperature indications.

1 57. A method of displaying temperature as color, the method comprising:  
2 obtaining temperature indications;  
3 translating each temperature indication into a plurality of basic constituent colors by  
4 computing a plurality of color intensity values, one color intensity value per basic  
5 constituent color;  
6 generating the colors of the plurality of basic constituent colors, each generated basic  
7 constituent color having intensity determined by the color intensity value of said each  
8 basic constituent color; and  
9 converging the generated basic constituent colors.

1 58. The method of displaying temperature as color according to claim 57, wherein the  
2 step of obtaining temperature indications comprises the steps of:  
3 acquiring analog temperature indications; and  
4 digitizing the analog temperature indications.

1 59. The method of claim 58, wherein the step of generating the colors comprises the step  
2 of driving a plurality of currents through a plurality of substantially monochromatic  
3 LEDs, a current per LED, each LED emitting one of the basic constituent colors.

1 60. The method of claim 59, wherein the step of converging comprises the step of using a  
2 lens assembly to align the basic constituent colors emitted by the LEDs.

1 61. The method of claim 60, wherein the step of driving a plurality of currents comprises  
2 the step of driving a plurality of pulse-width modulated currents, each pulse-width  
3 modulated current having a duty cycle determined by the color intensity value of the  
4 constituent color corresponding to the LED driven by said each pulse-width modulated  
5 color.

1 62. The method of claim 61, wherein the step of acquiring analog temperature indications  
2 comprises the step of producing analog indications with substantially linear dependence  
3 on temperature.

1 63. The method of claim 58, wherein the step of generating colors comprises the step of  
2 displaying the colors on a screen.

1 64. A method of displaying temperature as color, the method comprising:  
2 step for obtaining temperature indications;  
3 step for translating each temperature indication into a plurality of basic constituent  
4 colors by computing a plurality of color intensity values, one color intensity value per  
5 basic constituent color;  
6 step for generating the colors of the plurality of basic constituent colors, each  
7 generated basic constituent color having intensity determined by the color intensity value  
8 of said each generated basic constituent color; and  
9 step for converging the generated basic constituent colors.

1 65. An article of manufacture comprising a machine-readable storage medium with  
2 instruction code stored in the medium, said instruction code, when executed by a  
3 processor of a system comprising the processor, an output device capable of displaying a  
4 plurality of basic constituent colors, and an input that receives indications of temperature,  
5 causes the processor to perform the following steps to display the temperature indications  
6 as color:  
7 receiving temperature indications;  
8 translating each temperature indication into a plurality of basic constituent colors by  
9 computing a plurality of color intensity values, one color intensity value per basic  
10 constituent color; and  
11 causing the output device to generate the colors of the plurality of basic constituent  
12 colors, each generated basic constituent color having intensity determined by the color  
13 intensity value of said each basic constituent color.

- 1 66. A method of displaying temperature of an automotive audio component as color, the  
2 method comprising:
- 3 obtaining temperature indications of the audio component;
- 4 translating each temperature indication into a plurality of basic constituent colors by  
5 computing a plurality of color intensity values, one color intensity value per basic  
6 constituent color;
- 7 generating the colors of the plurality of basic constituent colors, each generated basic  
8 constituent color having intensity determined by the color intensity value of said each  
9 basic constituent color; and
- 10 converging the generated basic constituent colors.